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# Strategic War Gaming

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# NAVAL WAR COLLEGE REVIEW

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# STRATEGIC WAR GAMING

A lecture delivered
at the Naval War College
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by

Dr. Erwin Baumgarten

War games take many different forms, ranging from the ancient game of chess to elaborate computer simulations. Some are parlor games played for entertainment or as intellectual exercises. Others are meant for the serious study of a wide spectrum of political, military or economic conflicts. The popularity of serious gaming is increasing rapidly, both in the military and elsewhere. I should like to mention some indicators of this trend:

A flag officer was designated as Assistant for War Gaming in CNO two or three years ago. His office (Op-06C) is in the Plans Department. This officer is responsible for the Navy's extensive war gaming program.

Several universities are experimenting with political and diplomatic games as educational devices.

Gaming is being explored as a technique for executive training in industry. *Fortune* magazine carried a long article on business games in March 1958.

Incidentally, the whole group of serious gaming activities is often called "operational gaming" rather than war gaming, since gaming techniques have been generalized to non-military problems. This term is meant to emphasize the scope of modern gaming

activities. Traditional war games of strictly military problems are, of course, included. The game you are going to play next is a true operational game. Political and military elements are of roughly equal importance. The spirit of the game can be expressed by Clausewitz's famous dictum that "War is the continuation of politics by other means."

It has also become fashionable to give a distinctive name to each particular type of game. Unfortunately we do not have a convenient one for our local version of a strategic war game. Your nominations are invited. In the meantime, I am going to call it the Naval War College Game when I refer to it this morning.

You have read the study directive and heard Commander Johnson's orientation a few minutes ago. There is little point to describe the forthcoming game or go over the war gaming background in the directive. It seems more useful under the circumstances to indicate some of the key problem areas in strategic gaming in general and relate these problems to your specific game. In this manner, I hope to give you a new perspective of the field of Strategic War Gaming as a whole.

Here are the topics that I am going to cover. By way of general background, I am going to start with an outline of the elements of operational gaming and go on to a description of a modern strategic game called SWAP. SWAP has quite a different flavor from any of the games now played at the Naval War College. It will serve to broaden your acquaintance with different game types. I will then spend a few minutes to discuss the implications of value problems in strategic gaming. The last topic is a personal appraisal of the role of gaming as a strategic planning tool.

*A. Elements of Operational Gaming*

To begin: Operational Gaming is concerned with the study of human conflict. It is perhaps best defined as paper or computer simulation of conflicts with live participants in decision-making roles. Simulations with actual physical equipment, such as fleet exercises, are normally not considered to be gaming activities.

Operational games are customarily classified under two headings, education and analysis.

Educational games are primarily exercises in decision-making. Participation in well-designed games also strengthens the players' understanding of the problems of the corresponding real world conflict.

Analytical games are planning tools, to evolve concepts, compare alternative courses of action and test plans. They are sometimes called predictive games. I personally do not like this name since it suggests clairvoyance.

Our Naval War College Game was constructed primarily for the educational function. But it also has certain aspects of an analytical game since it subjects your National Strategy Papers and JSCP's to a partial test.

Most of the political and military conflicts, which interest us here, are very complex. At first sight they seem to defy rational analysis altogether. To come to grips with the underlying problems we have to use a common scientific dodge, construct a more manageable model and study it in place of the real world situations. This is true regardless of the purpose of our study.

Before we can construct a model we have to identify the essential features of actual conflicts. Here is the list:

There are at least two opponents or players.

The players have opposing interests.

Neither controls the situation by himself. Both players have to recognize that the effectiveness of their moves depends at least in part upon the reactions of the opponent.

The outcome of military and political conflicts is never predictable with confidence. The uncertainty is only partly due to statistical or chance variation. Even more troublesome are the ever-present real uncertainties.

You may recall that I discussed the distinction between real and statistical uncertainties when I spoke about the application of statistics to certain military problems last August.

Because of the chance factor, probability and statistics are needed to analyze most conflict situations. But probability and statistics by themselves are not enough since they do not really help in outguessing the other fellow.

The interplay of action and reaction is the most characteristic feature of conflicts. It distinguishes decision problems involving human antagonists from all others in which we are only opposed by the impersonal forces of nature.

Operational Gaming is essentially an empirical approach to the study of consequences of possible enemy actions. Its mathematical counterpart is the Theory of Games. Gaming as such is, of course, much older than Game Theory. But modern gaming practices are strongly influenced by the mathematical theory, the theory invented by the late John von Neumann, a very versatile scientist who worked on atomic weapon development and later served as AEC commissioner.

Von Neumann began his study of conflicts by analyzing a stripped version of two-handed poker—not strip poker, though. His model studies gave von Neumann new insight into the basic nature of conflict and led him to the formulation of criteria for rational action in the face of intelligent opposition. A few game theoretical solutions to relatively straightforward tactical problems have by now become an integral part of standard Navy doctrine. Von Neumann himself had a hand in planning Operation STARVATION, the eminently successful mining campaign against Japan.

You may wonder at this point how a poker game could have any conceivable worth as a model of military or political conflicts. Actually, model building is more an art than a science. The proof of the pudding lies in the eating. Very simple models have often turned out to be the most useful. If you think about it for a moment you will see that a poker game has all of the essentials of conflict that I listed a moment ago.

I do not want to leave an impression, though, that practical decisions can now be made simply by the application of the proper mathematical formula. Most military and political problems are far too complex for explicit analysis. But Game Theory can often provide a framework for qualitative rather than quantitative study of conflicts. This alone is worthwhile. It helps to visualize the consequences of possible enemy actions and may clarify key issues. But the theory is no substitute for experience and good professional judgment.

If you want to look into Game Theory, I suggest that you read *The Compleat Strategyst*, by John Davis Williams. It is very nicely written. The cartoons are quite amusing. Another book that you may find interesting is Schelling's *Strategy of Conflict*. It attempts to analyze deterrent concepts in a game theoretical setting. Schelling's approach makes good sense to me. Neither of the books includes any mathematics.

Game Theory and Operational Gaming are not the only instances where study of parlor games led to practical applications. The same was true of classical probability theory whose economic value to insurance underwriting was recognized only after a couple of hundred years.

The accident of birth explains the frivolous names: Game Theory and Operational Gaming. It also accounts for some of the terminology common to both fields. I am going to mention some of the terms you are likely to meet in reading about gaming activities. To repeat: Game Theory is a rationale of conflicts. Operational Gaming is a paper simulation. Opponents are players. A player may represent an individual combatant unit, a fleet or a whole nation, depending upon the context. The only requirement is a common goal or objective. The rules of engagement are the game. In gaming the rules are often called "The Model." A single contest is a play of the game. The outcome determines the pay-off. The terminology also has military overtones. The players' courses of action are strategies, or occasionally tactics. Specific implementing actions during a play of a game are moves. The broad strategic framework or setting is commonly called the scenario.

Figure 1 shows schematically how conflict situations are simplified for Operational Gaming. Mandatory elements are two sides with opposing interests and an umpire. There are also more complicated multisided games, which I will mention later.

Each side may actually be a team, whose members are more or less independent but have a common goal. The players are free to act within the framework set by the rules of the game.

The umpire is interposed between the two sides to control the flow of information and take the part of nature. As such he simulates the "fog of war" that

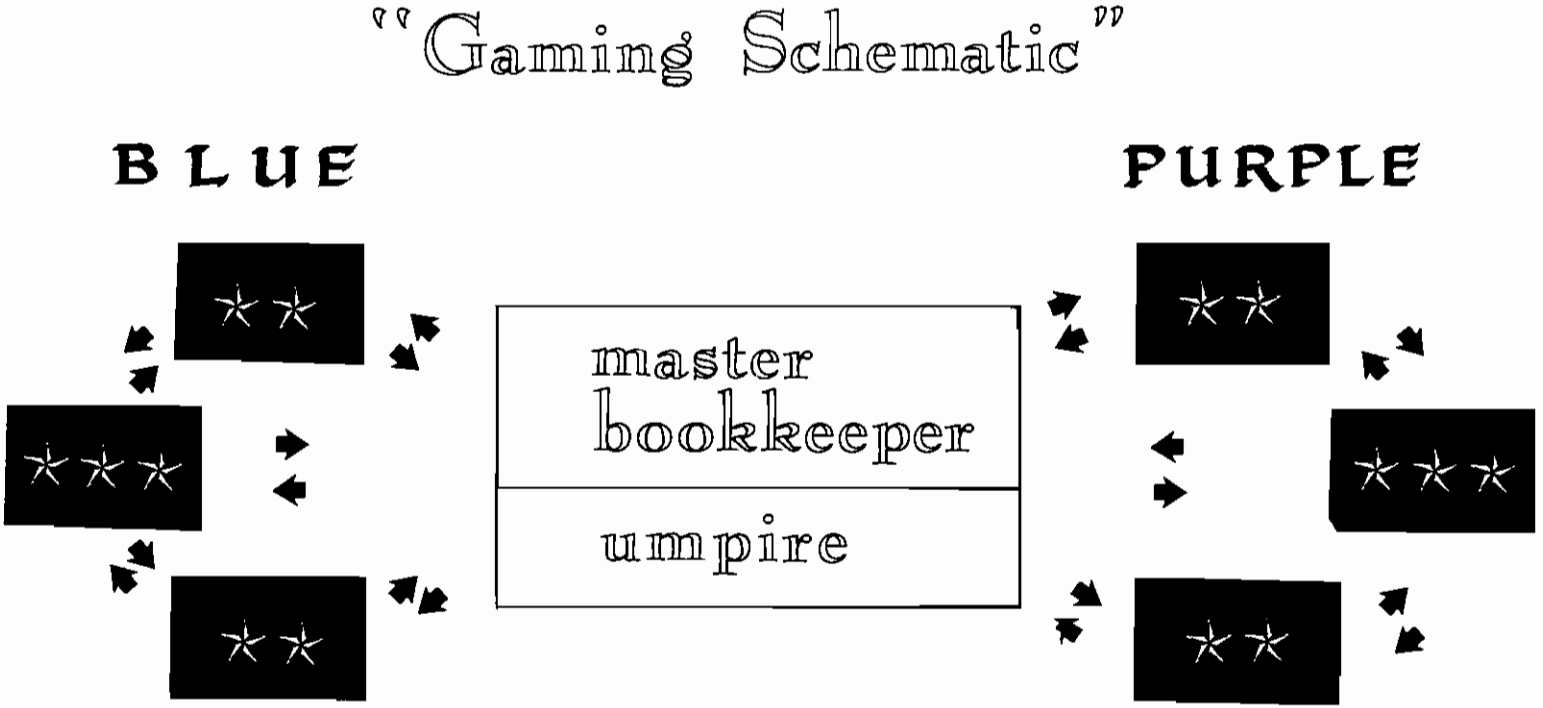


FIG. 1

keeps the players in partial ignorance of each other's moves. He also decides the outcome of engagements. The umpire usually has some kind of bookkeeping system to keep a true picture of the whole situation in front of him.

There are two basic types of games; "Rigid" and "Free." Rigid games are played in accordance with a complete set of rules for all contingencies. The umpire's role is primarily that of a go-between. All decisions are made by rolling the dice, or some other chance device. Realism has to be built into a rigid game beforehand. The rules have to reproduce the essential features of the prototype faithfully. Their construction demands professional judgment of the highest order.

The rules of free games are usually quite sketchy. Players are expected to conduct themselves in accordance with their previous experience in the real world. Umpires are given wide discretion. They may render their decisions solely on the basis of their professional judgment, without recourse to formal rules or chance devices. The success of a free game is largely determined by the qualifications and perception of the umpire.

Both types of games have advantages and disadvantages. It is perhaps a little harder to avoid bias in free games. Rigid games require much more effort, both in preparation and during actual play. It is, therefore, not surprising that fashions change. Rigid games were in vogue first. Free games were more in favor during the first half of this century. Rigid games came back recently. This was partly due to the advent of computers, which made rigid games more manageable. The increasing influence of analytical techniques in military matters may also have been a factor.

The mechanical aids for bookkeeping and umpiring take many different forms, depending upon the purpose

at hand. Here are some examples: Chart Maneuver, Game Floor, and Electronic Computer. But elaborate instrumentation is really not necessary. The simple game of "Battleship" has most of the necessary elements to qualify as a perfectly good operational game. Montgomery of Alamein often explored his moves on the back of an envelope, with his intelligence officer in the role of Rommel.

*B. A Strategic War Game (SWAP)*

This seems to be a good place for an example of a modern operational game. The one I am going to outline is called the Strategic Air War Planning Game—SWAP. It is a member of a family of RAND games for exploration of a number of different research and planning problems.

SWAP is concerned with the efficient allocation of a given budget for nuclear striking power in general war. It fits the simple "Gaming Schematic" of Figure 1. The conflict is strictly two-sided between the BLUE and PURPLE Defense Establishments. There are no provisions for interactions with third parties, either with other countries or with other national institutions.

SWAP is related to the JSOP very roughly in the same manner as your game is to the JSCP. But the analogy is not too good. This is no disadvantage from our point of view this morning. Comparing SWAP to the War College Game illustrates the need to tailor the structure and rules of games to the problems under study. SWAP's concern over economic constraints serves as a reminder that budget problems are strategic in nature. This factor is occasionally overlooked.

The broad strategic setting of SWAP conforms to the current view of "Protracted East-West Conflict" as a struggle without foreseeable end. Both players have to program capabilities for an all-out nuclear

exchange at an unknown time. The necessity to plan for adequate D-day readiness on a continuing basis is one of the most valuable features of SWAP. Admiral Burke has said repeatedly that trade-offs between early and late capabilities are among his hardest decisions.

SWAP has three phases, which I will now describe: Procurement, operational, and critique.

The procurement phase covers a five-year period. Initial conditions constrain both sides: Forces in being, firm programs, and fixed budgets. But players have money left over after they meet their already existing commitments. They allocate their disposable budgets for items on their shopping lists: Additional striking power, more defense, including tactical warning, research and development effort, or more intense intelligence activities. They do so year by year in five annual moves. Before each move the umpire furnishes last year's own R&D results and new intelligence about the opposition. R&D successes and the amount of intelligence are functions of the budget allocations in the respective categories. I will come to the intelligence and R&D models in a moment.

The operational phase is designed to test the aptness of the budget decisions. It consists of two flashbacks to different points in the time span of the procurement phase. Each flashback is a map exercise of an all-out exchange, played once along conventional lines.

The two D-days are chosen at random after completion of the sequence of the five budget moves. This procedure tends to keep the need for constant readiness without gaps before the players. But it is not entirely satisfactory. Knowing that the game ends after five years may tempt the players to cut out long lead-time procurement and R&D expenditures in the later budget moves.

The critique after the operational phase fortunately discourages this kind of unwarranted shortsightedness. It is an integral part of SWAP, as it is in most RAND games. Informal critiques can be most profitable. The free exchange of ideas often brings out the reasons for particular outcomes and gives a feeling for the sensitivity of results. Certain general principles may become apparent after playing a game only a few times. RAND has expressed considerable confidence in the validity of lessons learned from their Project SIERRA, a series of map exercises of limited wars.

This approach is logically similar to the one used by the 19th century strategists, who derived "principles of war" from a study of history. War games are, in effect, treated as if they were synthetic history.

By the way, you will have an opportunity to form your own opinions about the value of critiques. There will be a wash-up after your game.

SWAP is a completely rigid game with an exhaustive set of rules and little or no umpire discretion. RAND designed some clever gadgetry to keep the game playable without resort to computers.

The procurement phase is played on a "menu board." The menu board is similar to a chessboard. Each square represents a way of spending money, say more Polaris submarines, air-to-surface missiles for B-52's or satellite reconnaissance. Players get their budgets in the form of a stock of chips. Allocations are worked out by distributing the chips on the menu boards. The procedure is self-checking. There is no way to run up a deficit.

To simplify the operational phase a hexagonal grid is superimposed over the map. All combat actions take place at the centers of hexagons. Playing on a

grid is an old war gaming trick. But the hexagonal grid is better than the more common checkerboard pattern. Movements are less artificial; the circular ranges of active defenses are represented more readily.

The operational rules for SWAP differ from those of other map exercises only in detail.

The simulation of basic uncertainties during procurement is more interesting. A lottery model determines success of research, development and intelligence activities. A unit money allocation buys one ticket. Each ticket is a claim to a fixed probability of success. Buying several chances increases the probability. But no amount of money guarantees success.

To illustrate: Suppose a $100,000,000 program is given a 50% chance of achieving some operational capability by 1965. Nearly $400,000,000 would then be needed to raise the probability to 90%.

The intelligence model has a further refinement. It provides for two basically different types of error. The system may fail to produce the desired information. It may also come up with misinformation. In other words, the "Where there is smoke" principle is built in. The source of trouble may be a smoke generator, not a fire.

The unit probabilities for intelligence success and the two types of error have to add up to one. This means that increasing effort increases good and bad dope in proportion. Doing this is still advantageous, though. The greater over-all volume helps in evaluation and screening.

All in all, the SWAP uncertainty models are quite reasonable in principle. But assignment of success and failure probabilities is highly subjective.

This factor seriously limits the analytical utility of SWAP. In its present form, it may perhaps serve as a screening device for preliminary exploration of novel strategic concepts or rough comparison of radically different budget allocations. But I certainly would not want to trust it any further as a planning tool.

The arbitrary elements in the uncertainty models detract far less from the educational potential of SWAP. The structure of the game is quite realistic. It correctly reflects the qualitative relationships under study and poses the right kinds of alternatives to the players. Thus, SWAP can provide meaningful practice in decision-making. This is the key requirement for a good educational game. Whether the quantitative relationships, including the probability inputs, faithfully portray the real world is much less important by comparison. After all, we are placed into many different environments during our lifetimes and are constantly forced to make crucial choices. This is bound to happen, whether we like it or not.

The question of the validity of inputs arises in all operational gaming. It becomes particularly vexing in games with a future setting in an era of rapid technological change. Our own capabilities are at best poorly defined. They are always bold projections from insufficient data and become little better than guesses when the time span of the extrapolation is long. Estimates of enemy capabilities tend to be even worse. His unit performances are merely mirror images of ours.

Where does all this leave us with regard to the probability inputs stipulated in your game directive? I am sure that I am not telling you any secrets, if I admit that the Naval War College does not own a crystal ball. Everybody shares your misgivings. None the less, I suggest that you do not fight the problem and accept the probability models for what they are

worth. The inputs were prepared quite carefully. They should be good enough for the primary purpose at hand—to make the game a useful exercise in decision-making.

*C. Value Problems in Strategic Gaming*

The question of the fidelity of models is by no means the only difficulty in strategic gaming. The choice of objectives can be even more troublesome. To state the problem in gaming language: It is often not at all obvious how to value gains and losses and assign the players pay-offs.

It is true that objectives can usually be taken pretty well for granted at the tactical level. In general, we will not go far wrong if we regard battles as two-sided, zero-sum conflicts, in which losses of one side are gains to the other. A zero-sum relationship greatly simplifies the choice of proper objectives.

The situation becomes much more complicated at higher levels of action. Let us briefly consider an overseas transport campaign that one might well play on the NEWS as a theater level strategic game. At first sight losses of cargo ships and submarines suggest themselves as pay-offs and were in fact widely accepted for this purpose early in World War II. But it became apparent as the war progressed that we had to look further than the outcome of engagements at sea.

The function of the transport operation was the delivery of cargo at the destination. Saving ships and sinking submarines were just means to this end. The allies soon found that they could cut their losses substantially by sailing ships in convoys and routing them evasively. However, doing this materially increased ship cycle times and adversely affected delivery rates. This meant that the U-boats could

score a success without ship sinkings if they could force traffic into convoys and onto circuitous routes. Conversely, the allies could gain a real advantage by improving port efficiencies. Shortening ship turnaround times could increase delivery rates just as well as sinking U-boats.

You see that choosing a satisfactory pay-off for an overseas transport game is a complicated matter. Total cargo delivery during the campaign seems to be pretty good, despite some shortcomings. With this pay-off, ship sinkings and U-boat kills are still important. But they are not the whole story.

I should now like to mention an even more dramatic indication of the subtlety of strategic criteria taken from the field of air warfare. The wartime strategic bombing campaigns were generally directed against industrial and transportation targets in order to hamper arms production. At the same time, there was a widespread feeling that careful target selection was really not necessary and that generalized urban damage would be quite sufficient to disrupt the enemy's war effort. However, the postwar bombing survey uncovered some rather convincing contradictory evidence.

Three heavy air raids in quick succession devastated Hamburg in the spring of 1945. A fire storm obliterated a large area of tenements and subsidiary service facilities in the center of town. It appeared at first sight that Hamburg could be written off as a war production center, even though the major industrial plants on the outskirts had suffered surprisingly little damage.

But this was not so. Hamburg's productivity before the raids had been limited by labor shortages. As in all city bombing in World War II, except Hiroshima and Nagasaki, property destruction in Hamburg was out of all proportion to population casualties.

The raids freed additional labor for war work and paradoxically increased arms production. In a sense, the overkill due to the fire storm helped the German war effort so that the attack defeated its own purpose.

I think that the brief discussion of the overseas transport and strategic bombing problems illustrates the difficulty of formulating appropriate pay-offs for strategic games even at the strictly military theater level. Consensus about objectives becomes progressively rarer as we move to higher decision levels. The current debate about the choice of deterrent weapon systems is a case in point. Divergencies of opinion about values and objectives are at the roots of the controversy.

Going back to SWAP for a moment. In this type of game basic military postures are crucial. Players have to know whether they are aiming primarily for "first strike" or "retaliatory" capabilities before they can intelligently allocate their resources and write operational plans. You recall that the players in SWAP act in the roles of their respective Defense Departments. Decisions about basic posture do not properly belong at this level. They have to be made by the SWAP control group before the game and treated as inputs by the players.

To have free choice of basic military postures, the scope of the game has to be expanded into the political domain. Highest national decision levels have to be simulated. Here, value judgments become central strategic issues. This factor makes policy determinations exceedingly difficult.

A useful political game has to reflect the realities of the existing international system (Figure 2). Independent actions of many nation players have to be considered. The conflict between the two main protagonists stands out above all others. The main

# POLITICAL GAMING

## MULTISIDED WITH ALLIANCES

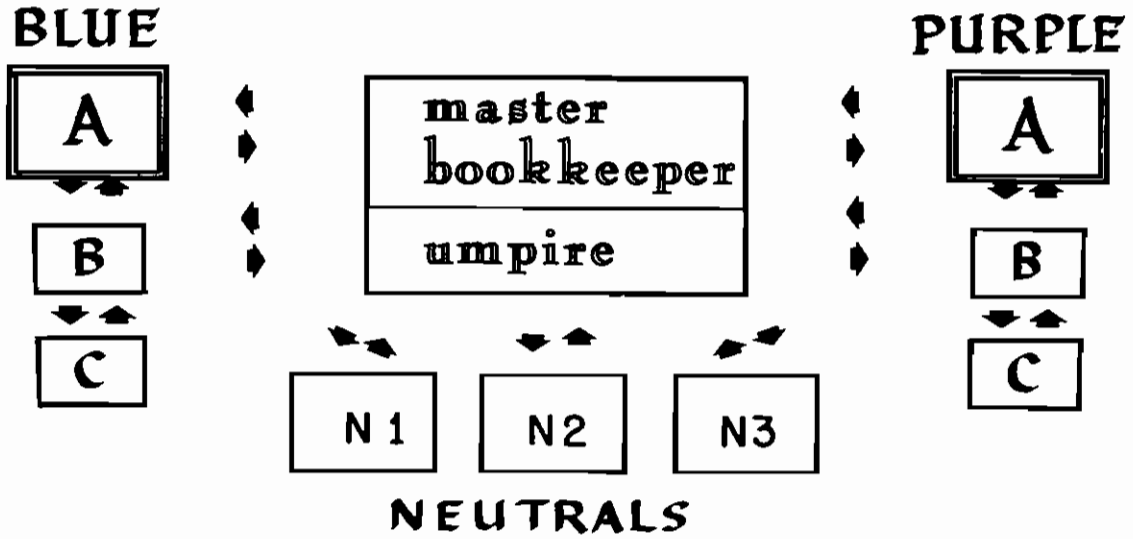


FIG. 2

protagonists are leaders of alliances of sovereign powers. A number of neutrals are also in the game. The nation players themselves are, in effect, very tight coalitions of domestic interests. The main protagonists are strongly antagonistic. However, it is important to recognize that they also share certain vital interests. Nor can parochial domestic interests be neglected altogether.

A simple two-sided, zero-sum model is clearly inadequate for gaming at the political level. To go to the other extreme and represent all of the interlocking interests by independent players would be very clumsy, to say the least. Construction of a political game of the rigid type looks hopeless. In this regard, conflicts of interest within alliances and common interests between the main protagonists pose unresolved problems. So far it is not at all clear how to simplify the complex international system for study by gaming techniques. But, of course, political gaming is still in its infancy. The political games I have heard about are limited to diplomatic interactions between a moderate number of nation players. One successful game was conducted in a United Nations forum. These games are essentially negotiating exercises.

The Naval War College Game is in some respects more ambitious. As far as I know it is the only attempt to date that allows a full range of political and military actions in the same game. Simplifying compromises had to be made to make this practical. There are just two opposing nation players, each represented by a supreme political authority and the top two echelons of military command. But the game is only superficially two-sided. The control group will simulate necessary actions of the remainder of the international system to provide a realistic environment for the exercise in decision-making on the part of the active players. There are no formal rules for political umpiring, for obvious reasons. Umpiring of

military actions will also rely heavily upon the personal judgment of control group personnel. But here they have the help of the formal umpire rules listed in the directives. I am sure that you realize that the control group is faced by a formidable task. Be patient if they seem to favor the other fellow. Your turn will probably come next.

*D. Gaming as a Strategic Planning Tool*

The last topic is the applicability of gaming as a strategic planning tool.

The first recorded use of strategic gaming goes back more than 100 years. The Prussian Army started to game campaigns against Austria in 1848, foreshadowing the "Seven Weeks War" of 1866. Gaming techniques were employed extensively as final tests of war plans by the General Staffs of Western Europe throughout the second half of the 19th century. High-level planning of this era was preoccupied with the military exploitation of the then-new rail nets. Strategic gaming therefore concentrated upon mobilization and logistics, rather than upon combat problems. On the whole, these gaming activities appear to have been well worth the effort.

War games occupied a prominent place in the curriculum of the Naval War College almost from its inception. The early games had important analytical elements in addition to their primary educational function. They apparently had a direct impact upon U.S. Naval policy. The games of 1895 indicated the strategic value of a Cape Cod Canal. Those of 1903 contributed to the formulation of the principle of concentration of the battle fleet.

The Axis powers in World War II made extensive use of gaming both in the early planning stages and for final testing after plans had been written. Axis experience generally seems to support the utility of gaming technique as planning tools.

Map exercises of the amphibious attack on Britain disclosed basic operational difficulties. The results may have contributed to Hitler's decision to abandon Operation SEA LION.

The tests of Plan BARBAROSSA indicated that German resources at hand were barely sufficient for successful invasion of Russia under the most favorable circumstances.

Turning now to the eastern end of the Axis, basic Japanese war plans were evolved in a series of political games in 1940. Specific campaign plans were subjected to test by gaming later on.

The political games were elaborate affairs, conducted in the so-called "Total War Research Institute." The major world powers were simulated. NIPPON was represented by a coalition. Army, Navy, Cabinet and key economic activities were portrayed as quasi-sovereign agencies.

The Tokyo games suffered from unmistakable bias in favor of the home team. Some of the participants recognized a decided lack of realism in the planning. The bias reflected itself in arbitrary decisions. Game directors repeatedly upset umpire rulings that did not agree with their preconceived notions. The test of MIDWAY plans illustrates this tendency. Admiral Ugaki nullified a ruling which placed two Japanese carriers out of action. As you know, history soon endorsed the original assessment, which Ugaki had overruled as "unrealistic."

Let me now list some of the strengths of gaming as a strategic planning tool.

Solution of complex strategic problems usually demands the application of a variety of skills. It then becomes a group effort. The gaming environment helps to give each type of expert a hearing and forces

all participants into recognition of each other's difficulties. The game setting may be a better way to bring a number of different backgrounds together than either the committee approach or the conventional study team.

By gaming, problems may be investigated in broad context. This is important when interactions are poorly understood and critical factors cannot be isolated. Conventional methods of analysis then become difficult if not impossible. Often-repeated war games may produce new insight under these circumstances. The Navy War Gaming Program hopes to do just this through its computer gaming activities at APL/JHU and elsewhere.

Gaming subjects the planner's ideas to the rigorous test of intelligent opposition. Relying upon the authors of a plan to find its flaws amounts to controlled schizophrenia. To make someone else the devil's advocate is really much better. Providing a competitive environment for testing of plans is perhaps the greatest virtue of gaming.

Gaming also has decided weaknesses. Good games are expensive. Preparation is time-consuming. Players have to be well-qualified for their assigned roles. Games conducted by inexperienced players may have large educational pay-off. But the significance of results is always suspect.

In using gaming to approximate enemy reaction, we must never lose sight of the fact that the part of the opposition is taken by our own people. Americans just do not think like Russians! Let us also remember that a game is merely a simulation. A person may act quite differently under the pressures of real responsibilities.

The validity of gaming is critically dependent upon umpire objectivity. Biased games are worthless.

The Japanese experience is a case in point. Merely accepting the roll of the dice during the game is only the first step. Proper construction of rules beforehand is just as essential.

I will not attempt to give an appraisal of educational gaming. Your own experience as participants this year will give you a much better feeling for the educational value of war gaming than I could give you this morning.

*E. Summary*

I will now recapitulate the main points of the lecture:

Strategic gaming is a paper simulation of human conflicts at the international level. It tries to come to grips with a very basic difficulty—the problem of enemy reaction.

Gaming activities have two broad functions—education and analysis. Educational games should be regarded primarily as exercises in decision-making in conflict situations. They also add to the players' appreciation of the complexities of underlying problems. Analytical games are planning tools. They are often excellent to test plans and uncover flaws. Gaming can help in evolving new strategic concepts and may add to an understanding of the rules of complex engagements. Both types of games can get us into trouble if the models are faulty, inputs are biased or otherwise seriously in error, or if the value judgment implicit in the strategic objectives are inappropriate for the real problem. These difficulties are inherent in all problems involving the interplay of action and reaction. They have to be faced regardless of the method of solution. In balance, gaming is an excellent technique for the study of conflicts.

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